METHOD FOR CLADDING THE BLADE TIPS OF ROTOR BLADES OF A GAS TURBINE POWER PLANT AND DEVICE FOR CARRYING OUT THE METHOD

The present invention relates to a method and a device for carrying out the method for cladding the tips of rotor blades of a gas turbine power plant, using oxidation-resistant metal layers having embedded Al oxide particles, Si carbide particles, Cr oxide particles or similar hard particles.

The gap present between the rotor blade tips and the associated intake coating present in modern gas turbine power plants is very tight, in order to keep the gap loss, that influences the efficiency, low, so that, during operation, as a result of prevalent thermal stresses and acting centrifugal forces, a brushing contact may occur of the blade tips and the intake coating. This leads to the blade tips cutting into the intake coating, which should, to the greatest extent possible, take place without wear and without great heating. It is known, in this connection, that one should develop the coatings on the stator side to be relatively soft (abradable) and on the rotor side relatively hard (abrasive) as so-called cladding.

Such cladding of the blade tips, as is commonly known, is applied by coating using metal spraying of carbides and/or oxides, by soldering on hard grains, or even by welding on hard materials.

The present invention is based on creating a new method for cladding such blade tips, which makes possible, in a fashion simpler than up to now, a dimensionally correct cladding in a fail-safe manner.

According to the present invention, the object is attained by applying the metal containing the embedded hard particles as a Co layer or an Ni layer onto a solder foil which, depending on the geometry of the blade tip that is to be clad, is cut to size as a blank, and, using a moving device that generates a pressure force, whose foil holder has a roughened surface, the blank, after inductive heating of the blade tip, is melted onto the latter while applying surface pressure.

However, the coating of the solder foil with a metallic layer including hard particles may also be performed by galvanic nickel coating, using dispersed hard particles.

According to another feature of the present invention, the generation of the abrasive surface of the cladding takes place, according to the present invention, by having a ribbed or pimpled surface of the foil holder of the moving device generating the pressure force during the melting-on procedure, in which the ribbed of pimpled surface is impressed into the surface of the melted-on layer, the melting-on preferably taking place under a protective gas.

After the melting-on of the cladding onto the blade tips, excess solder should be mechanically removed from the clad blade tip.

A device for carrying out the method according to the present invention includes a foil holder having a roughened surface for accommodating a metallic blank having abrasive properties and by a rotor blade holder accommodating a rotor blade as part of a rotor of a gas turbine power plant having means for the inductive heating of the tip of the clamped stator blade, the device being designed in such a way that, between the foil holder and the blade holder a predeterminable pressure force is able to be applied.

The method according to the present invention for cladding rotor blade tips has a series of advantages. Thus, for instance, if there is appropriate dimensioning of the length of the blade in the state ready for installation, one may omit a processing of the blade tips. The connection of the blade tip and the metallic layer takes place very rapidly, and the layer used for the cladding has an optimum adherence, since a metallic connection is produced between it and the blade tip. As was mentioned before, it is possible to apply a dimensionally correct coating. As a result of the impressed grooved or pimpled surface of the metal layer, the structure of the surface acts in a cutting manner and, during application, it prevents a great heat input into the rotor blade.

The method according to the present invention will be described below in the light of an exemplary embodiment of a device for carrying it out, shown more or less schematically in the drawings. The figures show:

Fig. 1 a representation in perspective of a rotor blade of a rotor forming a part of a gas turbine power plant,

Fig. 2 a sketch shown partially in section of a device for carrying out the method according to the present invention for cladding the tips of rotor blades according to Figure 1, and

Fig. 3 one additional specific embodiment of a foil holder of the device according to Figure 2.

A rotor blade 10 of a rotor (not shown) that is shown in Figure 1 of a gas turbine power plant (also not shown) includes a blade root 11 and a blade tip 12, which is provided

with an abrasively acting cladding 14. This cladding is made up of a metal layer that is resistant to oxidation and has embedded in it Al oxide particles, Si carbide particles, Cr oxide particles or similar hard particles.

In order to apply this cladding to blade tip 12 of the rotor blade of the rotor that is not shown, a metal containing the embedded hard particles is applied as a Co layer or an Mn layer onto a solder foil, which is cut to size corresponding to the geometry of the blade tip that is to be clad, and is laid down as blank 16 (cf. Figure 2) onto a foil holder 17 of a device that is only partially shown. The foil holder is provided with a roughened surface, for instance, in the form of geometrically arranged grooves 19, as in Figure 2, or of geometrically arranged pimples 21 in foil holder 20, as in Figure 3.

Each rotor blade 10 that is to be furnished with cladding 14 is individually mounted in a blade holder 18 and is guided there in a recess 23, to be movable back and forth. Via the blade holder, the rotor blade is lowered onto blank 16 that lies upon foil holder 17, and in this process it is heated using induced high frequency current. When the working temperature of the solder foil is attained, the foil holder is pressed with pressure force against tip 12 of the rotor blade that is clamped in the rotor blade holder, so that, when the metal that includes the embedded hard particles is melted onto the blade tip, the groove pattern or the pimple pattern is impressed into the latter.

The melting takes place under protective gas, and the equipment for this is also not shown, since it is known per se.

After taking out the rotor blade, now having the clad tip, from the blade holder, excess solder and coating are mechanically removed.

Instead of cladding a solder foil using a Co metal layer or an Mn metal layer having embedded hard particles, the solder foil that is to be processed to form blanks 16 may also be provided by nickel plating with the metal layer containing the embedded hard particles in dispersed form.